Please replace the entire paragraph at page 4, lines 1-24 as follows:

In recent years, there have been developments and attempts to improve the conventional sheet metal manufacturing process and to improve efficiency of the overall process. For example, computer-based systems and robotic manipulators and controllers have been developed to provide a greater level of automation in the production process of sheet metal components. Further, research and development has taken place in the field of intelligent/expert systems for automatically generating and/or providing bending plan and other manufacturing information required to produce sheet metal components. For instance, U.S. Patent Application No. 08/386,369, entitled "Intelligent System For Generating And Executing A Sheet Metal Bending Plan", filed on February 9, 1995, in the names of David A. BOURNE et al., issued as U.S. Patent No. 5,969,973, the contents of which is expressly incorporated herein by reference in its entirety, discloses an intelligent, automated bending system which generates a bending plan and then executes the generated bending plan to produce a bend sheet metal component. The system disclosed therein includes one or more expert modules or subsystems for providing expert information, including tooling information, to a bend sequence planner, which determines and generates a final bending plan. A sequencer is also provided for executing the final generated plan, and for formulating and transmitting the appropriate commands to the various components within the bending workstation in order to produce the bend sheet metal components. In addition, U.S. Patent Application No. 08/338,115, entitled "Method For Planning/Controlling Robot Motion", filed on November 9, 1994, in the names of David A. BOURNE et al., issued as U.S. Patent No. 5,835,684, the contents of which is expressly incorporated herein by reference in its entirety, discloses an expert system for planning controlling the motion of a robot in order to facilitate the production of sheet metal components.

Please replace the two entire paragraphs from page 21, line 5 through page 22, line 17 with the following:

In accordance with an aspect of the present invention, an expert sheet metal planning and bending system (not shown in Fig. 1A) may be provided and implemented at a server module 32 of the facility 38. Such as expert system may include one or more expert modules or planners for generating and executing a bending plan for producing, for example, bent sheet metal components. These expert modules may include expert systems or subsystems for determining an optimum bend sequence and tooling requirements (including tool selection and tool stage layout) for the bending plan. In addition, for robot-based workstations, robot handling and motion experts or planners may be provided for determining the robot motion paths and holding steps for executing the bending plan. A repositioning expert may also be provided for determining the sequences and operations associated with controlling a repositioning gripper and repositioning operations of the robot. Such an expert system may incorporate, for example, the various features and aspects described in U.S. Patent Nos. 5,969,973 and 5,835,684. A more detailed discussion of an exemplary expert planning system that may be provided according to the various aspects of the present invention is provided below.

In addition to the provisioning of an expert system in the server module 32, an intelligent manufacturing system (not shown in Fig. 1A) may also be integrated or provided with the expert sheet metal planning and bending system of the present invention. Such an intelligent manufacturing system may be implemented at server module 32 and may be adapted to manage and distribute design and manufacturing information throughout the facility or factory 38. Various features may be provided with the intelligent manufacturing system, including the ability to search and retrieve previous job information from a central database, such as database 30, so that previous job information (which may include design

and manufacturing information of previously produced parts) may be used when generating a plan for developing a new part that has the same or similar features to that of a previously produced part. Further, the intelligent manufacturing system may also provide various graphical user interfaces in order to facilitate analysis of the bending plan by a machine or bending operator. By way of a non-limiting example, the various features disclosed in U.S. Patent Application No. 08/690,084, filed on July 31, 1996, entitled "Apparatus And Method For Managing And Distributing Design And Manufacturing Information Throughout A Sheet Metal Production Facility," in the names of K. HAZAMA et al., and U.S. Provisional Application No. 60/016,958, filed on May 6, 1996, entitled "Apparatus And Method For Managing And Distributing Design And Manufacturing Information Throughout A Sheet Metal Production Facility," in the names of K. HAZAMA et al., both corresponding to U.S. Patent No. 5,864,482, the contents of which are expressly incorporated herein by reference in their entireties, may be used and implemented in the intelligent manufacturing system.

Please replace the entire paragraph from page 25, line 21 through page 26, line 9 with the following:

As noted above, server module 32 may include various software-based applications for implementing an expert planning system (see, e.g., expert planning system 70 in Fig. 1B) and other systems, such as an intelligent manufacturing system (intelligent manufacturing system 60 in Fig. 1B). An interface module or application (not shown) may be provided at server module 32 for facilitating the transfer of messages and information between the various applications, and between the station modules and the server module. The interface application may be a separate module/application, or may be integrated (e.g., as one or more submodules) within the applications of the server module 32. In this regard, it is noted that the various features and aspects disclosed in U.S. Patent Application No. 08/706,830, filed on September 3, 1996, entitled "Apparatus And Method For Integrating Intelligent Manufacturing System With Expert Sheet Metal Planning And Bending System," in the names of K. HAZAMA et al., issued as U.S. Patent No. 5,822,207, the content of which is expressly incorporated herein by reference in its entirety, may be implemented to facilitate such integration and utilization of each application of server module 32.

Please replace the entire paragraph from page 37, line 1 through page 38, line 2 with the following:

Bend sequence planner 72 may operate in cooperation with tooling expert or planner 80, holding expert or planner 82, motion expert or planner 84 and any other experts (e.g., sensing expert 85) to produce a plan for complete part production by, for example, a bending workstation of the manufacturing facility. The production of the part may be based on the part designed with the use of the CAD or design system 74. The various features and aspects disclosed in U.S. Patent No. 5,969,973 may be utilized for implementing the various planners and expert modules of the expert planning system 70 illustrated in Fig. 9A. For example, bend sequence planner 72 may perform functions such as proposing a particular bend in a hypothetical bend sequence, and determining what initial steps must be performed by the system in order to execute such a bend having a position within the hypothetical bend sequence. In determining the consequences of the proposed bend, bend sequence planner 72 may query tooling expert or planner 80 as to what tooling would be needed to execute the proposed bend, query holding expert or planner 82 as to how the workpiece can be held while performing the proposed bend, and query the motion expert or planner 84 as to whether and to what extent the robot, which is holding the workpiece, can be manipulated to assist the making of the bend. If a sensing expert 85 is provided, bending sequence planner 72 might query sensing expert 85 as to whether a particular sensor-based control strategy is needed in order to facilitate the execution of the proposed bend by the workstation and the costs associated with a particular sensor-based control strategy. Bend sequence planner 72 may be configured to continually propose bends from a first bend consecutively to a last bend in a complete bend sequence, thus resulting in a complete set of bends to perform the final workpiece. Once the successful final bend sequence has been generated in this manner, bend sequence planner 72 may be configured to generate a final plan (which includes a general list

of steps and accompanying information needed to control execution of the various hardware elements of the bending workstation), and forward the plan to sequencer 76.

Please replace the entire paragraph from page 39, line 11 through page 40, line 6 with the following:

Motion expert 84 may be provided for generating a motion plan, i.e., the manner in which the robot should be maneuvered, in order to move the workpiece through various spaces and along various routes as needed to execute the bends. As noted above, bend sequence planner 72 and the respective experts may be modular to communicate with each other in a query-based manner. All message passing among planners may be accomplished by Feature Exchange Language (FEL), which is a query-based language that was developed by David Bourne at the Robotics Institute of Carnegie Mellon University. Further information concerning FEL may be found in, for example, U.S. Patent No. 5,969,973. Messages may be sent between the various planners to facilitate development of the bending plan and setup plan. For example, before deciding to include a particular bend as part of the bend sequence, bend sequence planner 72 may query tooling expert 80 as to whether there is sufficient tools to handle the bend. Bend sequence planner 72 will then await a response from tooling expert 80. Tooling expert 80 will recognize the query from bend sequence planner 72, and will return with a response, e.g., indicating that there are sufficient tools to handle that particular bend noted by bend sequence planner 72. By way of a non-limiting example, bend sequence planner 72 may also ask holding expert 82 if a robot arm gripper 14 can remain holding onto the workpiece during a particular bend operation without repositioning its grasp of the workpiece. Holding expert 82 will then respond to the query made by the bend sequence planner 72, and bend sequence planner 72 will then utilize the information to perform its next determination.

Please replace the entire paragraph from page 44, line 25 through page 45, line 11 with the following:

After selecting and determining the bending tools (from the available tooling resources) for each bending operation, the expert planning system may then determine the best possible bending sequence at step S.4. The bend sequence or operation sequence for each part may be determined at step S.4 by using various techniques, such as state space search methods, and analyzing each cost. By way of a non-limiting example, the state space search method and techniques disclosed in U.S. Patent No. 5,969,973 may be utilized to determine the bend sequence at step S.4. The determination of the bend sequence may be performed independently by the tooling planner of the expert planning system, or in cooperation with other planners/expert modules of the expert planning system, such as the bend sequence planner. Alternatively, the bend sequence may be designated by a machine tool operator or in accordance with a customer's requirements, and set in a data file read by the expert planning system.